

Emissions Inventory Help Sheet for Polyester Resin Application

Manufacturing products from polyester resins causes monomers in the resins to be emitted. Styrene, the most common monomer, is a volatile organic compound (VOC). Methyl methacrylate (MMA) is another less common monomer, also a VOC. Emissions (including DMP, MEKP and MEK) from the catalyst are normally very small and may be disregarded for this report.

What do I need to report?

- Report resins and gelcoats you used for fiberglass, cast marble (cultured marble), and gelcoat applications.
- Report cleaning materials used other than acetone, which no longer needs to be reported.
- Report dust generated by cutting or sanding wood, fiberglass, and marble.

What form do I use?

Use the Evaporative Process Form for resins, gelcoats and cleaning materials, which this help sheet addresses. Use the General Process Form for reporting dust emissions (see the Help Sheet for Woodworking). The "Instructions for Reporting 1999 Annual Air Pollution Emissions" has more information and examples of Process Forms.

What are my resin and gelcoat Emission Factors (EFs)?

Emission factors are given in the table on the next page. Recent EPA studies concluded that calculations using previous emission factors and formulas considerably underestimated emissions. Since many tests to determine emissions rates do NOT meet EPA specifications, most manufacturer's test data which claims emission factors different from those included in this help sheet cannot be accepted.

How do I report my materials on the Evaporative Process Form?

- Line 1 – The description should include the type of product manufactured and the method(s) of application.
- Line 2 – Use Tier Code 080412.
- Column 7 – Report as a separate process (a separate line with a unique process ID number) each EF that applies to your facility.
- Column 9 – Identify the material (resin or gelcoat) and its percentage of styrene (and MMA, if applicable). If you use more than one method of applying resin, report each method separately and identify the method here. Include enough information to verify the EF shown in column 12.
- Column 10 – Enter the number of pounds used (total resin or gelcoat with styrene and MMA but without fillers).
- Column 11 – The pollutant is VOC.
- Column 12 – Select or calculate the appropriate EF from the Emission Factors table on the next page. If the Material Safety Data Sheet (MSDS) for your resin shows a broad range of styrene and MMA content (% by weight), obtain specific values for your resin from a certification sheet or from the supplier or manufacturer. This percentage is as supplied, plus any extra styrene monomer you add, but before any glass, powders or fillers are added. If your resin or gelcoat includes MMA, you must calculate a single VOC emission factor including both styrene and MMA emissions and attach an Emission Factor Calculation Form. (See example Process 4 below.)
- Column 16 – To calculate emissions, multiply column 10 by column 12, and enter the result in column 16.

Examples:

Process 1: A spray fiberglass process used 20,000 lb. of resin, the MSDS for which showed 45% styrene content.

Process 2: A hand-layup fiberglass process used 5,000 lb. of resin, the MSDS for which showed 42% styrene content.

Process 3: A marble casting process used 6,000 lb. of a resin, the MSDS for which showed 37.5% styrene content.

Process 4: A process used 3,000 lb. of gelcoat, the MSDS for which showed 35% styrene and 10% MMA content. The VOC emission factor is calculated by adding the emission factors for styrene and MMA, $0.168 + 0.075 = 0.243$ lb/lb.

Following is part of the Evaporative Process Form showing these processes:

7	8	9	10		11	12		16
Process ID	Stack ID(s)	Material Type	Annual Usage Input	lb or gal	VOC, HAP&NON or NHx	Emission Factor	EF Units (lbs per)	Estimated Emissions (lb/yr)
1		<i>Spray resin @45% styrene</i>	<i>20,000</i>	<i>1b</i>	<i>VOC</i>	<i>0.141</i>	<i>1b</i>	<i>2820</i>
2		<i>Manual resin @42%styrene</i>	<i>5,000</i>	<i>1b</i>	<i>VOC</i>	<i>0.067</i>	<i>1b</i>	<i>335</i>
3		<i>cast marble resin @37.5% styrene</i>	<i>6,000</i>	<i>1b</i>	<i>VOC</i>	<i>0.0075</i>	<i>1b</i>	<i>45</i>
4		<i>Gelcoat @35% styrene + 10% MMA</i>	<i>3,000</i>	<i>1b</i>	<i>VOC</i>	<i>0.243</i>	<i>1b</i>	<i>729</i>

Styrene Emission Factors

Emission Rate in Pounds of Styrene (VOC) Emitted per Pound of Resin or Gelcoat Processed

[resin weight is "neat" (without filler), as applied]

Styrene content in resin/gelcoat, % ⁽¹⁾	<33 ⁽²⁾	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	>50 ⁽²⁾
Manual (Hand Layup)	$0.126 \times \% \text{styrene}$	0.041	0.044	0.047	0.05	0.053	0.056	0.059	0.062	0.064	0.067	0.07	0.073	0.076	0.079	0.082	0.084	0.087	0.09	$(0.286 \times \% \text{styrene}) - 0.0529$
Mechanical Atomized (Spray Layup)	$0.169 \times \% \text{styrene}$	0.056	0.063	0.07	0.077	0.084	0.091	0.098	0.106	0.113	0.12	0.127	0.134	0.141	0.148	0.156	0.163	0.17	0.177	$(0.714 \times \% \text{styrene}) - 0.18$
Mechanical Non-Atomized	$0.107 \times \% \text{styrene}$	0.036	0.037	0.039	0.04	0.042	0.043	0.045	0.047	0.048	0.05	0.051	0.053	0.054	0.056	0.058	0.059	0.061	0.062	$(0.157 \times \% \text{styrene}) - 0.0165$
Filament Application	$0.184 \times \% \text{styrene}$	0.061	0.064	0.066	0.069	0.072	0.075	0.077	0.08	0.083	0.086	0.088	0.091	0.094	0.097	0.099	0.102	0.105	0.108	$(0.2746 \times \% \text{styrene}) - 0.0298$
Gelcoat Application	$0.445 \times \% \text{styrene}$	0.147	0.157	0.168	0.178	0.188	0.199	0.209	0.219	0.23	0.24	0.25	0.261	0.271	0.282	0.292	0.302	0.313	0.323	$(1.03646 \times \% \text{styrene}) - 0.195$
Covered-Cure After Roll-Out	Emission factor [listed above] \times (0.80 for manual <or> 0.85 for mechanical application)																			
Covered-Cure Without Roll-Out	Emission factor [listed above] \times (0.50 for manual <or> 0.55 for mechanical application)																			
Marble Casting ⁽²⁾	$0.02 \times \% \text{styrene}$																			

Methyl Methacrylate (MMA) Emission Factors

Emission Rate in Pounds of MMA (VOC) Emitted per Pound of Gelcoat or Spray Resin Processed

MMA content in gelcoat / resin, % ⁽³⁾	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Spray Application	0.0075	0.015	0.023	0.03	0.038	0.045	0.053	0.06	0.068	0.075	0.083	0.09	0.098	0.105	0.113	0.12	0.128	0.135	0.143	$0.75 \times \% \text{MMA}$

Notes:

- (1) Including styrene monomer content as supplied, plus any extra styrene monomer added by the molder, but before addition of other additives such as powders, fillers, glass, etc.
 (2) The value for "% styrene" in the formulas should be input as a fraction. For example, use the input value **0.30** for a resin with 30% styrene content by weight.
 (3) Including MMA monomer content as supplied, plus any extra MMA monomer added by the molder, but before addition of other additives such as powders, fillers, glass, etc.

This table was adapted from the Technical Discussion of the Unified Emission Factors for Open Molding of Composites, 4/7/99, available on the internet at <http://www.cfa-hq.org/regulatory.htm>. Maricopa County converted the data to pounds of emissions per pound instead of per ton of resin/gelcoat. Vapor-suppressant reduced emissions and controlled-spray reduced emissions were omitted because EPA does not support that data. This table adds more categories of application.